of the cœlom, divided into right and left halves by median septa, each half communicating with the exterior by means of its own collar canal; on the posterior face of this cavity is an ectodermal thickening, which corresponds in position with the nerve-plate of *Cephalodiscus* and the nerve-tube of *Balanoglossus*. The collar cavities are continued upwards into the tentacles, and surround the mouth. From the pharynx a short diverticulum is given off upwards, which is continuous with a rod-like structure, apparently half cellular, half gelatinoid, which lies in the line along which the median posterior septum of the collar meets the nearly vertical septum between proboscis and collar cavities. It thus corresponds in origin, structure, and position with the notochord of *Cephalodiscus*.

The trunk contains the greater part of the alimentary canal. Its body cavity, as in the other Hemichordata, appears to be completely shut off from the paired cavity of the collar. The only part of the intestine calling for remark is a short semicircular diverticulum, which occurs also in *Cephalodiscus*.

The points in which *Rhabdopleura* differs from both the other Hemichordata are purely negative, viz., the absence of a proboscis pore or pores, and the absence of gill-slits; the points of agreement are so striking that it is impossible to separate the three organisms.

A more fully illustrated paper on the subject will shortly be published.

DESCRIPTION OF FIGURES.

Fig. 1.—Longitudinal section, taken slightly to one side of the middle line, so as to avoid the median septa of the collar region. The dotted line *e* marks the ventral limit of the collar.

Fig. 2.—Transverse section along the line *c*—*d* in fig. 1, through proboscis stalk and upper part of collar, and cutting the base of a tentacle of one side.

Fig. 3.—Transverse section along the line *a*—*b* in fig. 1, showing the external opening of one, the internal opening of the other, collar canal.

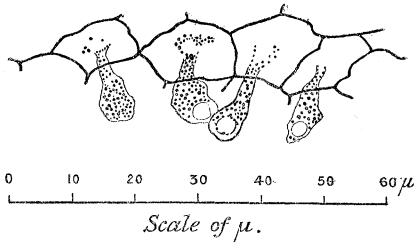
In all three figures the mesoderm is represented by a thick line, the ectoderm and endoderm by thin lines. The gelatinoid part of the notochord is marked by cross-hatching; its cellular part has not been distinguished from ectoderm or endoderm; *b.c.*^{1}, præ-oral cœlom, or proboscis cavity; *b.c.*^{2}, cœlom of the collar divided by the median septa into right and left halves; *b.c.*^{3}, cœlom of the trunk; *c.c.*, canals leading from the collar cavities to the exterior.

XII. "On the Flask-shaped Ectoderm and Spongoblasts in one of the Keratosa." By George Bidder. Communicated by Adam Sedgwick, M.A., F.R.S. Received June 15, 1892.

In my "Note on Excretion in Sponges," published by the Society in the 'Proceedings' of this year, I said: "Both from my own observations on an *Aplysilla* (?) . . . . and from a study of

Schulze's detailed description . . . . particularly in *Euspongia*, I am persuaded that the ectoderm cells of the horny sponges are of the same form and character as those in the Homocœla." By a piece of good fortune I am now able to state that this is so. In a sponge found at Naples, which appears to me to correspond fairly with O. Schmidt's *Cacospongia scalaris*, the ectodermal elements are quite plainly to be seen even with a low power; indeed in the specimen examined their arrangement is more regular, invariable, and easy to observe than in any sponge that I have yet investigated.

FIG. 1.



Ectoderm Cells of *Cacospongia, sp.*

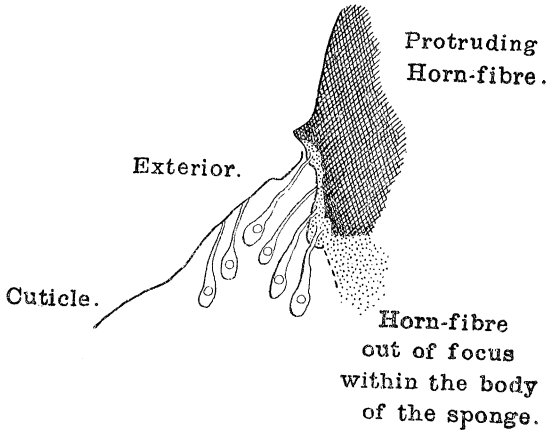
The cell-bodies are shown focussed through the silver-lines; the neck of each cell lies towards the upper part of the figure; it is at the same focus as the silver area, in the middle of which its granules lie on the outer surface.

Dilute osmic acid, followed by nitrate of potash and nitrate of silver.

The cells in question are of a flask-shaped form, very slender, elongated, and thin-necked. I have been able most successfully to demonstrate their relations to the silver areas (fig. 1), to prove without doubt that they open on the surface in the centre of those areas and not in any interstices between them, to prove also equally without doubt that each silver area has no nucleus connected with it except the one lying in the base of the pendent cell body ("subdermal gland-cell" of authors), and thus to justify completely the inability of Schulze and other trustworthy investigators to find nuclei at a more superficial level, where the "flat epithelium" was usually supposed to exist.

In this sponge the spongoblasts of the primary fibres form a continuous tissue with the ectoderm cells and resemble them indistinguishably both in form and character; a brief discussion of previous observation on this point will be found in the paper already quoted. It is nearly impossible—at least, for my inexperience—to give the effect of a three-dimensional preparation except by a most elaborate drawing, but the outlines given in figs. 2 and 3 will render some idea of the appearances on which I base this statement. The impression

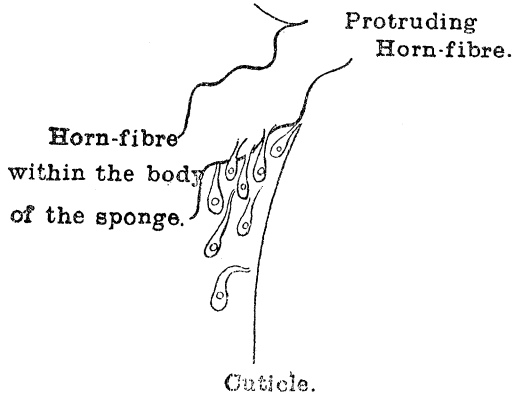
FIG. 2.



Ectoderm Cells at the apex of a conulus of *Cacospongia sp.* (Focus near the surface of the skin.)

The shading is diagrammatic; the dark shading indicates apparently naked horn-fibre, the light shading horn-fibre covered with living tissue.

FIG. 3.



Spongoblasts near the apex of a conulus of *Cacospongia sp.* (Focus near the profile of the fibre. Slightly smaller scale than fig. 2.)

Figs. 2 and 3 are from the same preparation, prepared with osmic acid, picro-carmine, and glycerine.

given is that the apex of a conulus is a locus of attraction for ecto-derm cells, and that the fibre is nothing more than the concentrated

cuticle of a large number of such cells poured out (in this sponge) around an intrusive foreign object.

I referred (*loc. cit.*), as if well known, to the "hexagonal markings of the horny fibre." I cannot, however, find any mention of them in the literature of the subject, except by Polejaeff ('Keratosa,' p. 70). As he there describes them as an exceptional structure, and as I find them not nearly so easily to be made out in *Cacospongia* as in *Aplysilla*,* it is possible that they have hitherto escaped notice. They are fine black lines, having the exact appearance of the network on the surface of an epithelium, and I regard it as beyond doubt that they mark the lines of contact between the expanded secreting ends of the spongoblasts.

An interpretation of the histology of *Ascetta clathrus*, differing considerably from mine, appears in the 'Zoologischer Anzeiger,' No. 391, for this year. It would be under-valuing Mr. Minchin's researches to attempt serious comment on them until I have had the opportunity of re-examining my preparations in the light of his conclusions. How far his theory of a contractile ectoderm may be applicable to such an extreme form as that found in *Cacospongia* is a matter demanding the gravest consideration.†

The newly-established points on which we find ourselves in agreement are: (1) The pores of *Ascetta clathrus* are composed each of a single, nucleate, perforated cell; these cells have by various authors been mistaken for mesoderm cells. (2) The ectoderm is, in life, in a large part composed of cells which are roughly ⊤-shaped in section, the nucleus lying at the base of the stalk of the ⊤.

On a minor and not very novel point we are in agreement as to there being, at any rate commonly, at least one vacuole in the distal part of the collar cell, frequently containing shapeless particles. As to our differences, I am undecided whether Minchin's mesodermal "potato-shaped wandering cell, of greenish-yellow colour," is what I

* The determination of these sponges must be taken with reserve; the fear of angels to tread among Keratose genera makes me postpone as far as possible my first step! Both species are found in the Bay of Naples. The "*Cacospongia*" is firm, massive, somewhat incrusting, conulate, with conspicuous antler-like primary fibres, heavily cored with foreign bodies; the delicate secondaries show in their axis fine black spots; skin black, pulp white. "*Aplysilla*" corresponds in general description with Schmidt's *Aplysina aërophoba*, the yellow crust bearing vertical twig-like prominences, mostly supported by a single fibre; under unhealthy conditions, the living part of the prominences contracts up the fibre like a bud. In the axis of the fibre—at least in one specimen—I have observed a row of indubitable cells, amœboid in appearance; presumably they are what Lendenfeld has described as "spongoklasts."

† It is obvious that the presence, as in this sponge, of a fairly strong cuticle, even though it be "elastic" (Schulze), renders it much more difficult to assume that the form of the cells has been produced by their contraction. (July 15.—The continuity with the spongoblasts greatly increases the difficulty of such an hypothesis.)

call a Metschnikoff cell or not. I consider the natural form of active collar cells, in this as in other sponges, as being more separated in their upper parts than in his figures, a large part of the surface of the cell being washed by the water; this area behind the collar I have always regarded as the ingestive surface. Mr. Minchin believes that he has obtained evidence that the ectoderm cells really push their way to the endoderm; holding the views I do as to excretion, I shall be very glad if re-investigation causes me to admit this correction.

Apart from our common ground, I have made the indigo-carmine experiments with which the Society has been acquainted, and Minchin has made his valuable observations on the changes in form of the epithelium surrounding the oscula of *Ascetta clathrus*.* Whatever weight should be attached to these two factors in deciding the meaning and function of the flask-shaped epithelium, I wish to establish the undoubted presence of such a structure in *Cacospongia*, and presumably in all Porifera. Examining *Cacospongia*, and comparing Merejkovsky's figure of *Halisarca*, any one will be convinced that this is the true explanation of the puzzling appearances seen by various authors on the outer surface of other sponges—I would take as examples, among very many, Schulze on *Halisarca Dujardini* and *Chondrosia reniformis*, Poléjaeff on *Janthella*, Sollas on *Stelletta Normani* and *Isops Phlegræi*, Vosmaer on *Tentorium* (*Thecophora*) and the larva of *Myxilla*. Vosmaer's figure of *Myxilla* (fig. 8, Pl. XIV), unites with Metschnikoff's of the young *Halisarca*, to show that the flask-shaped cells appear at the earliest stages, and are probably formed by direct metamorphosis from the columnar epithelium of the free larva. On the other hand, the direct observations of flat epithelium on the outer surface are strikingly few.†

I hold that it may take rank as an established fact that in all groups of sponges the flask-shaped epithelium does occur. It must be recognised that the structure we are to expect to find on the exterior of any sponge is a zone of hyaline tissue traversed by necks which unite the centre of each silver area to the nucleus and cell-body pertaining to it. This, whatever be its physiological explanation, is the structure most commonly to be met with, and not a flat epithelium, such as clothes the canals.

And I believe that these cells are excretory, and identical with the spongoblasts.

* I should say that I can support the figure he gives as being an accurate representation of transitions in form of epithelial cells to be met with in all the Calcarea. I have hitherto ascribed to them an entirely different significance—that where the wall is thin, the special elongated flask-shaped form of cell is not required for excretion.

† The descriptions of flat epithelium—generally flagellate—by R. v. Lendenfeld are numerous and detailed. I attach no credit to them.

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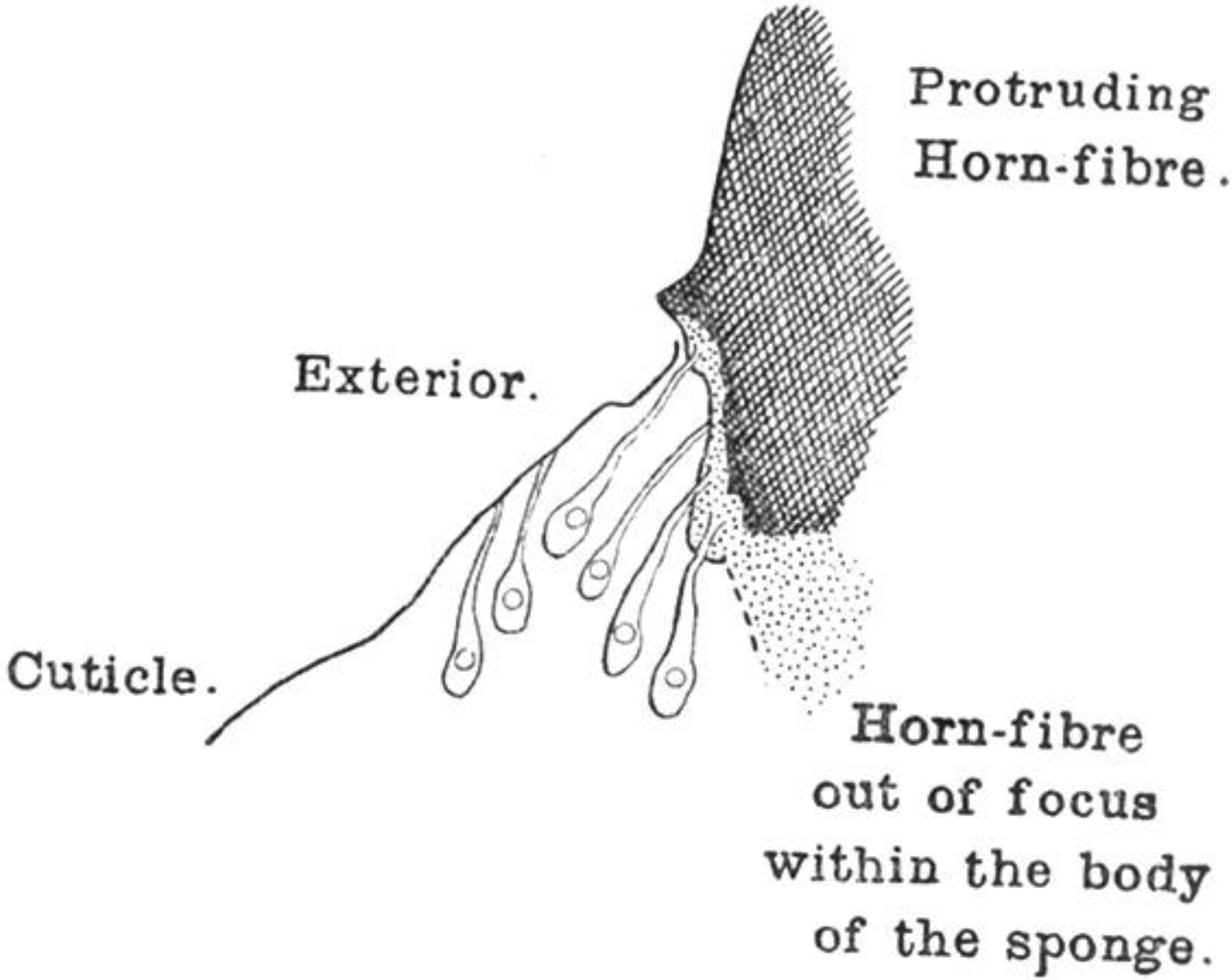
XIII. "Contributions to the Anatomy of Fishes. II. The Air-Bladder and Weberian Ossicles in the Siluroid Fishes." By T. W. BRIDGE, M.A., Professor of Zoology in the Mason College, Birmingham, and A. C. HADDON, M.A., Professor of Zoology in the Royal College of Science, Dublin. Communicated by Professor NEWTON, F.R.S. Received June 9, 1892.

(Abstract.)

An abstract of the first part of this memoir, which dealt with the structure and relations of the air-bladder and Weber's ossicles in the Siluridæ, was published in the Proceedings of this Society three years ago ('Roy. Soc. Proc.,' vol. 46, 1889, pp. 309—328). The present contribution is a discussion of the physiology not only of this remarkable mechanism, but of the air-bladder in general.

There is a strong *a priori* probability that the Weberian mechanism is physiologically related to one of the several functions that have been ascribed to the auditory organ or to the air-bladder, but to which of them is a question by no means easy to answer. A preliminary difficulty to be encountered is the complex physiological character of the two organs, and, apart from our imperfect knowledge of the physiology of the several functions assigned to each, and especially in the case of the auditory organ of Fishes, a further difficulty is

FIG. 2.



Ectoderm Cells at the apex of a conulus of *Cacospongia sp.* (Focus near the surface of the skin.)

The shading is diagrammatic; the dark shading indicates apparently naked horn-fibre, the light shading horn-fibre covered with living tissue.